MASTER THESIS

Collaboration and technological innovation within Dutch elderly care organizations

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Student

Name: Sterre Coenen (s2021838)

Public Administration - Local and Regional Governance

Faculty: Behavioural, Management and Social sciences

First supervisor

Name: prof. dr. René Torenvlied

Public Administration - Public Management

Faculty: Behavioural, Management and Social sciences

Second supervisor

Name: dr. Minna van Gerven

Public Administration - European Public Policy

Faculty: Behavioural, Management and Social sciences

UNIVERSITY OF TWENTE.

Preface

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Abstract

Demographic change, especially in the ageing society, is an important challenge for many countries and organizations across the globe such as China and the Netherlands. These countries face the same problem: a growing population of the elderly and a decline of the younger generation providing informal care. This way, elderly care organizations as well as governments face the task of supporting the increased flow of elderly who need care. In current society, technological innovations can support the provision of care for the population of aged people. However, technologies can be costly and time intensive. This way, collaborating is becoming more popular among organizations due to the use of joint resources. The current master thesis explores how collaborative networks of managers within Dutch elderly care organizations are constructed in order to develop, adopt and implement technological innovations. In addition, this master thesis will elaborate why these Dutch elderly care managers collaborate for technological innovation. Hypothesized is that differences exist in collaborative networks of elderly care organizations when developing, adopting or implementing technological innovations. An online survey was sent to institutionalized Dutch elderly care organizations which allowed to explore the networks of elderly care organizations for technological innovation (n=38). The results of the research indicate that characteristics of collaborative networks of elderly care organizations differ between adoption and implementation looking at the strong and weak ties within these networks. Furthermore, development activities are related to gaining knowledge, adoption activities found to be not related to political reasons and implementation found not be based on cost effectiveness but more in providing the needed service delivery. Technologies established within the current collaborations are focused on the safety of the elderly and mainly access sensors technologies. For the Public Administration science, these results gave incentives to further research the relation between governments and elderly care organizations to stimulate the establishment of technological innovations. Consequently, efficient decisions can be made in the light of developing policy that is compatible for governments as well as elderly care organizations. Relating this to the geographical changes in society, the elderly can be better supported with more advanced technological innovations such as robotics. In addition, more information about effective policy strategies for collaborating for technological innovation can enhance the establishment of more advanced technologies which can support the growing population of the elderly.

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1. Introduction

1.1 Background

The society in the Netherlands is shifting into an ageing and individualizing society, which is comparable to other countries such as China. These countries face the same problem: a growing population of the elderly and a decline of the younger generation providing informal care for them. The Statistics Netherlands, which constructs demographic forecasts in the Netherlands, estimates that in 2040 more than one third of the Dutch population will consist of the elderly (CBS, 2015). Due to the this shift, it is forecasted that the population share of people aged 80 and over living independent will be doubled compared to 2015 (CBS, 2015). In line with more independent elderly people, the stake of people aged 80 and over who live in nursing homes will decline from 30 till 8 percent in 2040 (CBS, 2015). Thus, the people are aimed to be more self-supporting whereas the needed care for them does not change. Consequently, governments and elderly care organizations need to change in order to adopt to the shifting society.

1.2 Elderly care organizations and the need for change

The Dutch national government reacted to the earlier mentioned shift by giving elderly care organizations incentives by changing law, regulation and money flows in order to prevent future societal problems of the elderly who do not receive care. In 2015, the Community Support Act (CSA) was implemented which made elderly care organizations subject to market forces. The CSA states that care services for needy people, like the elderly, have to be made suitable with local stakeholders like the municipality, client, caregivers and family (WMO, 2015). Because of this, Dutch elderly care organizations became hybrid organizations. Hybrid organizations are characterized by market competition as well as by governmental funding and regulation (Brandsen & van Hout, 2006). This way, since 2015 elderly care organizations had to change to keep up with the new market competition and conform to laws and regulation. More specifically, elderly care organizations had to change their organizational practices. In order to survive as an organization and support the growing population of elderly, innovation is necessary. Within current society, the use of technologies in elderly care organizations is growing since technologies can increase the quality of care, reduce the costs of care or solve problems within the workplace (de Veer & Francke, 2009; Nictiz, 2018; Ross et al., 2016). The best definition for technological innovation in the context of elderly care has been defined as '*new elements introduced into an organization's production system or service adoption for producing its products or*

rendering its services to clients' (Damanpour, Walker and Avellaneda, 2009, p.654). However, establishing technological innovations can be costly and time intensive. Collaborating for innovation can help to overcome by bringing relevant knowledge, ideas and resources together to produce the intended innovation (Torfing, 2018; Ansell & Torfing, 2014). This way, organizations are able to respond quicker to changes to gain competencies and increase their performance level (Walker 2006, p.650). Thus, elderly care organizations can benefit from collaboration in order to establish innovations and thus tackling the societal challenges of an increasing amount of elderly people who need care.

1.3 Collaborative innovation as a solution

Still much research towards collaborative innovation remains to be done (Ansell & Torfing, 2014; Sørensen & Torfing, 2011; Grudinschi et al., 2014). This is remarkable since evidence is found that collaborating increases the performance of the organization, and performance is partly determined by their innovation practices (Meier & O'Toole, 2001; Torenvlied et al., 2012; Andrews et al., 2011). Since elderly care organizations face market competition and are subject to laws and regulation, collaborative innovation could support them in current society (Sørensen & Torfing, 2017). Relatively little research is conducted on collaborative innovation in other public sector organizations, such as elderly care organizations (Ansell and Torfing, 2014; Bommert, 2010; Sørensen & Torfing, 2011). However, an analysis of American public innovations report that 60 percent of innovations are established through collaboration (Borins, 2001). Collaborative innovation in elderly care only consists of case studies and no scientific research is performed in the Netherlands at the moment of writing (Grudinschi et al., 2014; Sørensen & Torfing, 2017). The case study of Grudinschi et al. (2014) report that it would be relevant for further research to track down how capabilities and resources can be most effectively combined to create (social) value. Elderly care organizations create public value (Moore, 1995) and can support the growing population of the elderly by providing technological innovations.

1.4 Research topic

The latter gave spur for the study towards collaborative innovation in elderly care organizations. In order to provide a deeper understanding of collaborative innovation, the current master thesis explores the characteristics of elderly care collaborations in order to develop, adopt or implement technological innovations. The characteristics of collaborative networks of elderly care organizations will be the independent variable. Furthermore, the development, adoption and implementation of technological

innovations is conceptualized as *''technological innovation activities''* and entails the dependent variable. The reason for the name of the dependent variable is because the dependent variable defines how innovations are established within organizations with the support of collaboration. Elderly care organizations can develop innovations with different partners since the market does not provide specific technologies, can adopt innovations since others use it too or implement innovations because of urgency (Rogers, 2010; Gagnon et al, 2012; de Veer et al, 2011; O'Toole, 1997). Besides that, this thesis gives more detailed information about the type and function of collaboratively established technological innovations. This way, detailed information about collaborative (technological) innovation in elderly care is provided which can benefit the practical field which are current collaboratively established technologies in elderly care. For the scientific field, the exploration of collaborative innovation in hybrid organization adds up to current understanding of how and why collaborative innovations takes place (Grudinschi et al., 2014; Sørensen & Torfing, 2011).

1.5 Research question

Following from above, the research question is formulated as: '*To what extent are characteristics of collaborative networks among Dutch elderly care organizations associated with technological innovation activities?'*. In addition, three sub-questions are defined. The first descriptive sub-question is: '*What are the characteristics of collaborative networks of Dutch elderly care organizations for technological innovation?*'. The second descriptive sub-question is formulated as: '*What technologies are developed, adopted or implemented among collaborative networks of elderly care organizations?*'. Based on this, the last causal sub-question is developed: *''How are these characteristics of collaborative networks related to technologies in elderly care?*'. These sub-questions serve to gain insights in how development, adoption and implementation activities and characteristics of collaborative networks of elderly care organizations are related to technologies. Furthermore, these sub-questions will support the ability to answer the main research question.

1.6 Goal

The first aim of the master thesis is to provide quantitative data, instead of qualitative data, about the network behaviour of Dutch elderly care managers in establishing technological innovations. The reason for this is that quantitative data is recommended to support the understanding of collaborative innovation (Sørensen & Torfing, 2011; de Vries, Bekkers & Tummers, 2016). The second aim is to explore

collaborative innovation in Dutch elderly care organizations. With network theories it is tried to explain collaborative innovation in elderly care. The master thesis is conducted from October 2018 till December 2018 and reported a study towards the relationship between collaboration and technological innovation of Dutch institutionalized elderly care organizations. The research report 38 (location) managers of these Dutch institutionalized elderly care organizations. The results are descriptive and the outcomes are aimed to further research collaborative innovation in hybrid organizations.

2. Theoretical framework

Lack of understanding of Collaborative networks for the development, adoption and implementation of innovations exist (Sørensen & Torfing, 2017). This is unfortunate since the strategy of networking affects the performance of the organizations (Sørensen & Torfing, 2017; Schalk, Torenvlied & Allen, 2010; Torenvlied et al., 2012). As stated in the introduction, elderly care organizations increase their performance by collaborative technological innovations thus reducing complex problems (Sørensen & Torfing, 2017).The following paragraph elaborates the relationship between characteristics of collaborative networks of elderly care organizations and their technological innovations activities. The chapter is divided into three paragraphs relating to collaborative networks and the three technological innovation activities: development, adoption and implementation of technological innovations. Since elderly care organizations are risk averse organizations which create public value, these organizations relate more to public organization than private organizations (Osborne & Brown, 2013; Moore, 1995). Consequently, the used theory in the theoretical framework will be mainly from the Public Administration literature.

2.1 Collaborative networks and the development of technological innovations

The development of technological innovations entails '*all the decisions, activities, and their impacts that occur from recognition of a need or problem, through research, development, and commercialization of an innovation, through diffusion and adoption of the innovation by users, to its consequences' (*Rogers, 2010, p.40). More specifically, the development of technological innovations is the preface of adoption and implementation when a problem rises to high priority which needs research (Rogers, 2010, p.40). In order to grasp the problem and solve it, the development of technological innovations is supported when a diverse set of partners is accessible that hold a variety of perspectives and resources (Termeer & Nooteboom, 2014; Bekkers, Tummers & Voorberg, 2013). Moreover, partner diversity can overcome

organizational barriers of developing the intended innovation by gaining specific knowledge, support and skills (Termeer & Nooteboom, 2014). The other way around, continuing to collaborate with similar partners results in exclusion of resources, competencies and knowledge that are beneficial for the development of innovations (Sørensen and Torfing, 2017). Thus, a high partner diversity can enhance the development of technological innovations.

In order to find a diverse set of partners to develop a technology, strong ties are more important in the development activities than weak ties. This because weak ties are favourable to explore which partners are appropriate for collaborating where strong ties are more beneficial for exploiting partners with needed resources to get a desired result (Hansen & Villadsen, 2017; Granovetter, 1985; March, 1991). Weak ties are characterized by infrequent contact with many partners in order to gain the right resources, knowledge and competences (Hansen & Villadsen, 2017; Bekkers, Tummers & Voorberg, 2013). However, strong ties are necessary to gain trust among potential partners and result in investing more time in having contact. Moreover, meeting partners frequently has proven to develop strong ties (Hansen & Villadsen, 2017; Meier & O'Toole, 2001). Furthermore, strong ties are helpful for building trust, which is beneficial for strong and cohesive partnerships when collaborating with different types of partners (Schalk, Torenvlied & Allen, 2010). For the development of technological innovations, strong ties enhance commitment from members to the process which is found to be an influential factor to successfully establish innovation (Ansell & Torfing. 2014). At the same time, Bekkers, Tummers and Voorberg (2013) indicate that both strong or weak ties offer opportunities for developing innovation. This way, the outcome can be that strong ties as well as weak ties enhance the development of innovation. However, since the strong ties argument is stronger the following expectation is hypothesized (1a):

H1a: *Collaborative networks of elderly care organizations with a high partner diversity and strong ties are more involved with the* ***development*** *of technological innovations as compared to their adoption or implementation activities.*

In current literature, technologies in elderly care are more focused on the adoption and implementation of them (Greenhalgh et al. 2004; Cresswell & Sheikh, 2013). Available literature about development activities and technologies states that the success of technological innovations depends on the development with their potential users (Greenhalgh et al. 2004; Rogers, 2010; de Veer et al., 2011). However, the involvement of many partners enhance the time and start-up costs when developing a technology (Ross et al. 2016). Elderly care organizations are found to be risk-averse organizations which affects the development of technologies (Osborne & Brown, 2013). Consequently, it is expected that

elderly care organizations prefer to collaboratively develop technologies that are already presents positive results, since this reduces costs and are not completely new. Consequently, it is expected that more traditional technologies are developed within collaborative networks compared to the other technological innovation activities. These traditional technologies related to development activities are defined as: technologies that are used and familiar by the general elderly population but currently lack support to help with for instance elderly's visual, motor or auditory capacities (Djellal & Gallouj, 2006). The complex part of this definition is that the traditional technologies intuitively relate to technologies that are not advanced. However, the view in the current thesis is that traditional technologies can be upgraded to fit elderly's needs. This way, these traditional technologies can be seen as not completely advanced technologies but adding new features can be the reason for development. More specific, improving the quality of services can be the main reason. Since precise literature lacks about these relationships, in the following thesis will be explored what technologies are developed by collaborative networks of elderly care organizations. Hence, in hypothesis 1b is it expected that more traditional technologies are developed within collaborative networks of elderly care organizations compared to the other technological innovation activities:

H1b: *Technologies **developed** in collaborative networks of elderly care organizations are more traditional than technologies adopted or implemented.*

2.2 Collaborative networks and the adoption of technological innovations

Adoption of technological innovations entails 'the *initiation, all of the information gathering, conceptualizing, and planning for the adoption of an innovation, leading up to the decision to adopt and implementation, all of the events, actions, and decisions involved in putting an innovation into use'* (Rogers, 2010, p.48). Often, adoption of technology is a process of re-innovating a technology to a specific context (Damanpour & Schneider, 2009). Before further elaborating the relationship between collaborative networks and adoption of technological innovations, one can make a distinction between adopting and implementing innovations. This is necessary since adoption and implementation are somewhat intertwined or overlapping (de Veer et al, 2011). Besides this, the definition of Rogers mention implementation which give aim to further define the two activities.

In this study, adoption and implementation are viewed separately since a difference exists between taking over innovation from others and implementing innovations (Cresswell & Sheikh, 2013; Damanpour & Schneider, 2008; Ansell & Torfing, 2014). A second reason for the separation is that health care, compared to other industries, is characterized by slower progressing technology (Cresswell &

Sheikh, 2013). The reason for slower progressing technology is that more stakeholders are involved than in other industries (Cresswell & Sheikh, 2013). Besides this, elderly care organizations have found to be adopting technological innovations by incentives from other parties like government of health confederations (Ross et al., 2016). In addition, elderly care organization attend conferences to be for instance inspired by technological developments in the elderly care field (Ansell & Torfing, 2014). The latter does not mean that the technological innovation is implemented. This way, the time from adoption to implementation is longer, making the two concepts more interesting to investigate separately.

A review of 101 studies about adoption of innovation (Gagnon et al. 2012) showed that organizations adopt innovations that provide a relative advantage over existing practices. This is relates to re-innovating as stated above (Damanpour & Schneider, 2008; de Veer et al., 2011). A side note is that a relative advantage of the technology does not directly lead to widespread adoption (Greengalgh et al., 2004). In order to know about technologies providing an advantage over existing innovations, collaborating with many different partners enhances the adoption of new knowledge (Simonin, 1997). The potential of the innovation is often elaborately discussed in the adoption activity (Greengalgh et al., 2004). Therefore, weak ties are important since these help in finding the right partners and stakeholders, which have different knowledge and perspectives, necessary to enhance knowledge (Hansen & Villadsen, 2017). In addition, a high partner diversity support the gaining of this knowledge and perspectives (Termeer & Nooteboom, 2014). This way, elderly care organization can make a thorough decision to adopt a desired technological innovation. Based on these arguments the following hypothesis (2a) is derived:

H2a: *Collaborative networks of elderly care organizations with a high partner diversity and weak ties are more involved with the* ***adoption*** *of technological innovations as compared to their development or implementation activities.*

The adoption of the technological innovation must include clear benefits, good usability, less costs, trialability and have to fit to existing technologies in the organization (Gagnon et al., 2012; Creswell & Sheikh, 2013). A more specific example of a relative advantage is replacing medical information on paper to digital medical records since this increases the work speed (Gagnon et al, 2012). So, the quality of the service or product increases. Most probably, elderly care organizations adopt technologies that are more advanced because they show more relative advantage than existing technologies. Furthermore, advanced technologies like robotics or virtual reality are expected to be collaboratively adopted. A possible reason to collaborate to adopt technologies is that it can provide those specialized services. In

this study, these technologies will be explored and further evaluated in the chapter 4. The corresponding hypothesis is constructed:

H2b: *Technologies **adopted** in collaborative networks of elderly care organizations are more advanced than technologies developed or implemented.*

2.3 Collaborative networks and the implementation of technological innovations

Implementation is defined as: '*when the individual puts an innovation into use'* (Rogers, 2010 p.41). As stated above, in health care organizations the time from adopting to implementing is extensive**.** Implementation of innovations with other partners occur successful when uncertainty is small and some institutionalization exists (O'Toole, 1997). This way, the institutional cues support organizations since public organizations are more risk-averse and institutionalization offers rules that reduce this uncertainty (O'Toole, 1997; Osborne & Brown, 2013). According to Sørensen and Torfing (2017) implementing innovations within a collaboration refers to good communication who bears the costs and benefits. The importance of good communication relates to the importance of having strong ties since these ties create trust among members of the collaboration (Hansen & Villadsen, 2017; Granovetter, 1985). Commitment and learning is also stated as important to successfully collaboratively implement innovations (Ansell & Torfing, 2014). It is expected that commitment and learning is easier with a smaller group of people who are somewhat diverse, which has been found as one of the most influential factors in successfully implementing innovations (Ansell & Torfing, 2014). The downside of partner diversity within a collaboration is that this raises conflict, in turn hindering innovation in terms of time and costs. Building trust, providing joint resources and connecting can help in overcoming this barrier (Termeer & Nooteboom, 2014). Consequently, the arguments above are defined in hypothesis 3a:

H3a: *Collaborative networks of elderly care organizations with a low partner diversity and strong ties are more involved with the **implementation** of technological innovations as compared to their development or adoption activities.*

De Veer et al. (2011) reported that in the previous three years the most implemented technologies reported by nursing staff in elderly care organizations were electronic information systems and distant care technologies. Furthermore, implementation of innovations depends mostly on the complexity, adaptability, compatibility with existing systems and costs of the innovation (Ross et al. 2016). More

specifically, technologies have a higher chance to be implemented when the innovation is cost effective (Ross et al. 2016). Cost-effective technologies implemented in collaborative networks are expected to provide more services. Therefore, the following hypothesis 3b is formulated:

H3b: *Technologies **implemented** in collaborative networks of elderly care organizations are relatively cost-effective than technologies developed or adopted.*

3. Methodology

3.1 Sample and sampling

This thesis consists of 394 Dutch institutionalized elderly care organizations which are member of the confederation ActiZ. The ActiZ confederation protects the interests of Dutch elderly care organizations and operates as a mediator between members of the confederation, politicians, stakeholders and society. The studied elderly care organizations are hybrid organizations. Hybrid organizations are quasi-governmental organizations. In other words, these organizations are both private and public organizations. Moreover, elderly care organizations compete for contracts and are subject to laws and regulations (Christensen & Lægreid, 2011). Because of this, approaching ActiZ was suiTable for the study. ActiZ was approached in August 2018 and e-mail details from 394 Dutch elderly care organizations were received. The data in this study was retrieved in October and November 2018 via the online program Qualtrics. The respondents were asked to fill in the online questionnaire by e-mail. In the e-mail it was explicitly mentioned that the questionnaire was meant for the location managers of these institutionalized Dutch elderly care organizations. A location manager refers to a manager responsible for a location within the elderly care. Because location managers are the most informed about technological innovations within the organization, location managers are most suitable to be sampled in this research. Details about the respondents in this study, the location managers, are described in Table 1.

Table 1: *Descriptive statistics of the sample: mean, standard deviation, minimum, maximum and total respondents*

Variable	***Mean (Std.Dev)***	***Minimum***	***Maximum***	***N total***
Gender (1=male; 0=female)*	39% male 61% female	0	1	38
Age	50(10,11)	27	65	38
Experience in elderly care	19(12,45)	1	42	37
Experience in organization	7(7,06)	0	33	38
Work hours	37(5,21)	24	50	38
Number of employees	105(118,81)	0	450	36
Number of clients	635(1437,94)	0	8000	37
Care diversity	4(1,41)	0	5	38
*Type of elderly care organization**			‘	
Home care	79%	0	1	38
Nursing home care	92%	0	1	38
Nursing care	87%	0	1	38
Revalidation	53%	0	1	38
Domestic help	47%	0	1	38

**Note:* The categorical variables (gender and type of elderly care organization) are mentioned in percentages

Deriving from Table 1, within the sample, more females (61%) are present than males (39%). Most of these location managers are in the age category of 40 till 60 old. These location managers are quite experienced in elderly care because on average they have 19 years of experience in this field. However, the experience in elderly care can range between 6 and 31 years. In contrast to earlier findings, the average experience in the organization is 7 years and ranges between 0 and 14 years. This result indicates that these location managers are experienced but switch between organizations. Most of the location managers work fulltime and have an average of 105 employees and 635 clients. However, Table 1 indicates that the number of employees (σ=199) and clients (σ=1437) differ between organizations. Furthermore, most organizations within the sample offer nursing home care (92%), nursing care (87%) and home care (79%). The mean (μ=4) and standard deviation (σ=1,4) of care diversity indicates that most elderly care organizations offer more than two types of care. It follows that most organizations in

this sample are probably large in size. The survey had many missing respondents which resulted in 38 respondents that were reported to show clear results. Consequently, a missing value analysis is conducted which can be found in Table A1 in Appendix A.

3.2 Research design and procedure

As mentioned before, the data was collected through an online questionnaire via Qualtrics from the beginning of October 2018 until the end of November 2018. The questionnaire was validated by an elderly care manager before publishing it via Qualtrics. The questionnaire (Appendix B) contained 90 times translated from Dutch to English. The survey took approximately 15 to 20 minutes to complete. The first invitation to fill in the questionnaire resulted in 30 respondents who finalized the questionnaire. After the reminder, the total number of respondents who finalized the survey according to Qualtrics was 58. The first reason for the moderate response was the length of the survey because 166 respondents partly filled in the survey. In addition, a part of those respondents only opened the survey without filling in sections, which Qualtrics also reported as partly filled in. The second reason was that ActiZ simultaneously sent out a survey towards technologies in elderly care. This confused the respondents causing them not to fill in the survey. In order to make the sample representative about 20 percent of the total number of respondents was needed. Although this aim could not be reached, the dataset can nevertheless be useful for purposes of exploration.

3.3 Operationalisation

The questionnaire existed of three sections, see Appendix B. The general information about the respondents was used for understanding the sample. The other two sections were used for answering the main research question. In the following paragraphs, the operationalisation of the variables will be given.

3.3.1 Characteristics of collaborative networks

In order to explore collaborations of elderly care organizations for technological innovation, the following question was formulated: *'Can you name two most important collaborations in which you have developed, adopted and/or implemented one or more technological innovation(s)?'*. The answer to this question supports the rest of the survey by referring back to the specific collaboration. With the help of the Qualtrics, earlier answers could be integrated into new questions. Consequently, the respondent

was better informed to which collaboration the question referred. The information derived from these questions was not progressed in the results. In the light of privacy, this information could link names of collaboration to respondents.

The characteristics of collaborative networks is measured with the theory of partner diversity and the presence of strong and weak ties. These characteristics are conceptualised as follows. Strong tie networking is characterised by regular contact with partners, low amount of persons and a low geographical scale (Hansen & Villadsen, 2017; Granovetter, 1985; Huszti, David & Vajda, 2013). In contrary to strong tie networking, weak-tie networking is characterised in measure by low contact frequency, large number of partners and a high geographical scale (Hansen & Villadsen, 2017; Granovetter, 1985; Huszti, David & Vajda, 2013). Partner diversity refers to the extent of collaborating with different partners (Sørensen and Torfing, 2017; Termeer & Nooteboom, 2014). Further in the section will be specified how contact frequency, number of partners and geographical scale exactly relate to strong or weak ties and what a high or low partner diversity is. All these measurements relate to the characteristics of collaborative networks.

Within the questionnaire the number of partners is measured with the question: '*How many persons are in collaboration*?'. The survey allowed an open-ended response. After changing the answers into numbers, the variable was constructed as a scale variable. A high number of partners in a collaboration relates to having more than eight partners which pertains to weak ties. A low number of partners in a collaboration relates to having less than five partners which pertains to strong ties.

Geographical scope was measured with the question 'W*hat is the geographical scope of the collaboration?*'. The variable had an ordinal level of measurement which ranged from (1) neighbourhood scope to (6) international scope. The numbers 1 to 3 indicate a low geographical scope which benefits the developing strong ties (neighbourhood, municipality, regional). In addition the numbers 4 to 6 indicate a high geographical scope which relates to developing weak ties (provincial, national and international).

The variable contact frequency was measured with the question '*How often do you have contact with members of the collaboration*?'. The variable had also an ordinal measurement and ranged from never (8) to daily (1) and was recoded from never (0) to daily (7). The new scores of the variable shows that a higher number indicate more intense contact with partners and a low number indicate little contact. More concrete, having daily to monthly contact indicate beneficial for strong ties and a few times a year to never indicate advantages for weak ties.

Next to strong and weak-tie networking, partner diversity was measured with the question *'What type of partners are within the collaboration?'* and showed twenty answer opportunities (see Appendix B question 7 and 18). The variable partner diversity was constructed as follows: A low partner

diversity indicates that the organization only works with partners that are quite similar to them. A high partner diversity indicates that the organization has many different partners. The question allowed for multiple responses which resulted in twenty answer options constructed as dummy variables (0=other; 1=partner X). Next, the categories had to be merged to five categories. The first category consisted of educational organization consisting of 1=primary and secondary schools and knowledge institutions (university, graduate school, secondary vocational education) and zero (0) indicated others. Next, clients, health care employees and client councils were merged together into a dummy variable (1) where 0 indicates respondents not belonging to this category. Third, public organizations was merged together that contained 1=of municipality, province, national government, non-profit organizations and police and 0 related to other. Fourth, private organizations consisting of consultancy, private organizations, product developers and police (1) and 0 related to other. Lastly, health organizations consisted of health trade association, physiotherapists and revalidation, elderly care organizations, hospitals and health insurance companies (1) and other were referred to as 0. To indicate partner diversity, these categories were summed and a high number indicated collaborating with much different partners. Since the categories consist of 5 different types of partners a low partner diversity is conceptualised as collaborating with 2 or less different partners. A high partner diversity indicate collaborating with more than two different partners.

In order to understand why elderly care organizations collaboratively develop, adopt or implement technologies, this research also explores the reasons for collaboration and the resources extracted from the collaboration. The questions were formulated as follows *'What are the three first and foremost reasons for the collaboration?'* and *'What are three most important resources that can be derived from the collaboration?'*. The variable reasons for collaborations existed of 11 multiple choice answers and resources of 10 answer options which are both based on literature of Rogers (2010) and de Vries et al. (2015) and were related to innovation characteristics. In addition, other resources extracted from the collaboration and resources were based on literature from Sørensen & Torfing (2017), Greenhalgh et al. (2004), Gagnon et al. (2012) and Creswell & Sheikh (2013). These questions give more understanding about hypotheses 1b, 2b and 3b since it is expected from theory that developed technologies provide quality of services, adopted technologies add to provide specialized services and implemented technologies create more services.

3.3.2 Technological innovation activities

The variable technology activity was conducted through the question *'Did you develop, adopt and/or implement this technological innovation?'*. The answers consisted of developed, adopted and implemented. This question could be answered by three multiple choice options: developed, adopted

and implemented. For instance, the question allowed to both adopt and implement innovations but these were not treated as such. Furthermore, these answers were computed into three dummy variables with state 0=no and 1=yes (developed, adopted or implemented).

3.3.3 Technologies in elderly care

Technological innovations in elderly care was measured with the question *'What is the most important technological innovation you developed, adopted and/or implemented'*. In Appendix D an overview of mentioned technologies per technology activity is included. The information was derived from open-ended questions in the survey and was included in Appendix D. The aim of Appendix D is to give a detailed overview which technologies are established within elderly care organizations.

To provide more clearance to those detailed names of technologies, the following questions about function and type of technology followed the earlier question. These were constructed as: '*Could you indicate to which type of technology the technological innovation belongs?'* and *'Could you indicate to which goal the technological innovation belongs?*. The answers that could be given on these questions were based on the overview of Tak et al. (2010), Goldwater & Harris (2011), Khan, Zia and Perera (2016) and information from the practical field. The choice for the distinction between type and goal of technology is that for example an organization can develop a robot but this robot can have different functions like preventing loneliness, allowing cognitive stimulation, assisting with daily life activities and so on. More specifically, the robot Paro helps to prevent loneliness of the elderly and the robot Zora helps with exercise. As such, it can be seen that robots can have different functions. The categories were translated into dummy variables. Since the research is exploratory the answer options were not merged as for example the variable partner diversity to provide more detailed information. From theory it is expected that traditional technologies relate to development activities. First, these traditional technologies can relate to technologies such as access sensors, motion sensors, GPS and communication technologies. Second, the more advanced technologies which relate to adoption activities can relate to bio-sensor technologies, robotics, cognition training and Virtual Reality (VR). Lastly, cost-effective technologies relate to implementation activities and can be telemedicine, communication technologies and e-health technology.

3.4 Data analysis

The whole analysis of the data was done by the program IBM SPSS. The data analysis was focused on a more descriptive approach to answer the main research question. First, methods as descriptive statistics

were used to gain insight into the first two sub-questions about the characteristics of collaborative networks and the frequency of technologies per technology activity. This way, the information supported the further analysis of the third and main research question. The method used for the third and main research question is cross-tables analysis. The method was used because it calculates the mean of characteristics of collaborative networks per technological innovation activity and per technology. However, due to the fact the survey allowed multiple response and categories could not be merged, the significance levels between groups could not be derived. Consequently, the relationship between groups could not significantly be reported. Nevertheless, the thesis provides exploratory understanding of collaborative networks of elderly care organizations for technological innovation. Figure 1 present the research model for the data analysis.

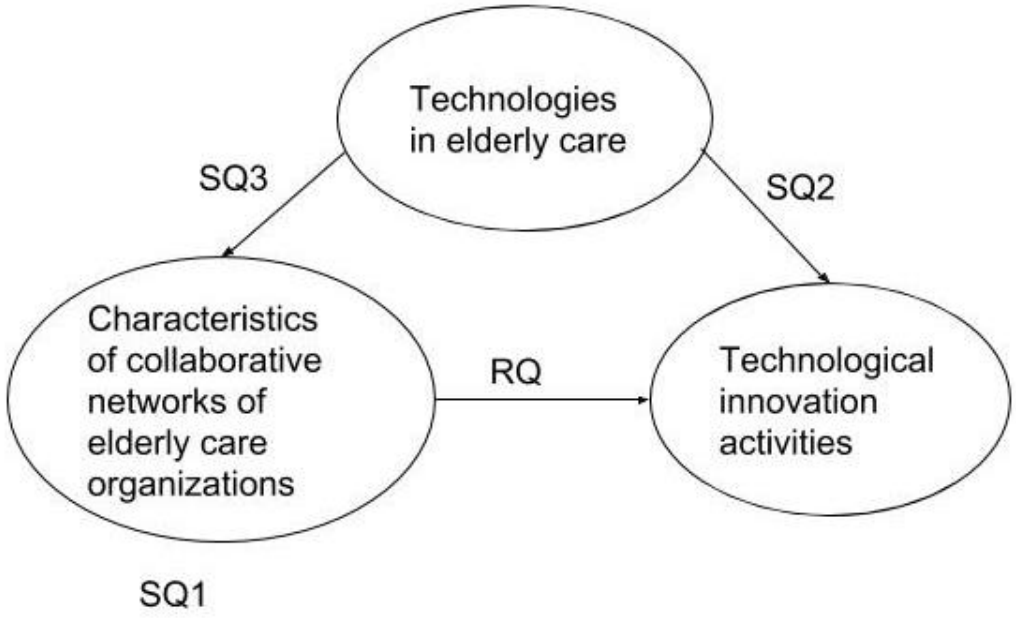

Figure 1. Research model for the data analysis according to the research questions

In Figure 1 it can be seen that the data analysis is structured according to the sub-questions (SQ) and main research question (RQ). Since the structure can be difficult to understand for the reader of the thesis, Figure 1 shows how the result section is structured to provide an answer to the RQ. Thus, first characteristics of collaborative networks of elderly care organizations will be given (SQ1). The reason for this is to provide understanding what the networks look like. The second sub-question will provide understanding if technologies established in the three technological innovation activities differ (SQ2). Next, the third sub-question support if the establishment of technologies differ for different network compositions (SQ3). And lastly, an answer could be given to the main research question (RQ).

4. Results

The first three sections are structured around the three sub-questions and the last section will provide the answer to the main research question based on the earlier (sub)sections.

4.1 Characteristics of collaborative networks

This section will give more understanding about the characteristics of collaborative networks of elderly care organizations. The first descriptive sub-question will be elaborated: '*What are the characteristics of collaborative networks of Dutch elderly care organizations for technological innovation?*'. Table 2 shows the descriptive statistics with mean and standard deviation and for categorical variables percentages are shown.

Table 2: *Descriptive statistics (mean and standard deviation) of the characteristics of collaborative networks in the two most important collaborative networks (C1,C2)*

Variable	***C1: Mean (Std.Dev)***	***C2: Mean (Std.Dev)***	***Mean C1 & C2 (Std.Dev)***
*Involvement of different types of partners**			
Educational	21%	13%	17%
Individuals	39%	26%	33%
Public	18%	16%	17%
Private	53%	45%	48%
Health	63%	39%	51%
Partner diversity	2(1,09)	2,(1,18)	2(1,13)
Number of partners	8(13,95)	3(3,82)	5,5(8,89)
Geographical scope	4(1,38)	4(1,55)	4(1,47)
Contact frequency	3(1,70)	2(1,62)	3(1,66)

**Note:* The categorical variable type of partners is mentioned in percentages

In Table 2, the top three partners within collaborative networks of elderly care organizations consist of health organizations (51%), private organizations (48%) and individuals (33%) taking the mean of collaboration 1 and 2. Besides this, it can be seen that elderly care organization least collaborate with

public and educational partners (17%). Additionally, collaborative networks of elderly care organizations consist on average out of two different types of partners (C1,C2: μ=2).

The mean number of partners within collaboration 2 (3) are less than collaboration 1 (8). This results in having implications for the discussion paragraph. Due to the fact that the average number of partners within a collaboration varies much between collaboration 1 (C1: σ=13,95) and collaboration 2 (C2: σ=3,82). In Appendix C, histograms are derived comparing number of partners, contact frequency and geographical scope. This is needed because it can explain how these variables are related to say something about strong and weak ties in general established by elderly care organizations.

Assumed is that a higher geographical scope involves a higher number of partners because they are in a large national network with different people for instance. And this is more related to having weak ties. Before elaborating this more, looking at the variable geographical scope in Table 2, collaborating at the provincial scope is most evident whereas collaborating on the neighbourhood level is not that frequent (C1: μ=4, σ=1,38; C2: μ=4, σ=1,47). Comparing this outcome with Figures C1 and C2 in Appendix C, number of partners and geographical scope, in both collaboration 1 and 2 at the regional scope the highest number of partners are involved in the collaboration compared to the national scope. However, it is assumed that geographical scope increases for a higher number of involved people because this creates weak ties. Concluding from the histograms in the Appendix C, the following assumption is not true.

The contact frequency variable can show if elderly care organizations on average have intensive contact or not. Moreover, this can explain having strong and weak ties. The average frequency of contact between members in the collaboration is monthly till a few times a year (C1: μ=3; C2: μ=2). Figures C3 and C4 in Appendix C show the relationship between geographical scope and contact frequency. Deriving from the histograms, most collaborative networks at municipal scope have weekly contact, networks at regional scope have a few times a year contact and provincial and national networks have monthly to a few times a year contact. As such, this gives some indication that the closer the geographical scope the more contact frequency takes place.

Additionally, contact frequency and number of partners is presented in Figures C5 and C6 in Appendix C. The histograms show that weekly contact is more frequent with a higher number of partners. Besides this, monthly contact is more frequent with an average number of partners and a few times contact per year with a lowest number of partners. These results contradict the strong and weak ties theory which indicates that a high number of partners with low contact frequency is associated with weak ties. The results suggest that more intensive contact is needed when collaborating with a higher number of partners. The following analysis with support from the histograms in Appendix C indicates that there are possible more dimensions within the collaboration. Moreover, technological

activities, such as development, adoption and implementing activities. This is going to be further analysed in the next sections.

In Table 3 the descriptive statistics of the reasons to collaborate and resources extracted from collaboration in the two most important collaborative networks is presented.

Table 3: *Descriptive statistics (frequencies in percentages) of the reasons to collaborate and resources extracted from collaboration in the two most important collaborative networks (C1,C2)*

Variable	***C1***	***C2***	***Mean (C1,C2)***
Reasons			
Specialized services	45%	39%	42%
More services	39%	21%	30%
Quality of services	61%	45%	53%
Efficient use resources	39%	45%	42%
Collective action problem	26%	24%	25%
Decrease risk	8%	0%	4%
Lobby	8%	5%	7%
Knowledge	34%	26%	30%
Organizational development	34%	26%	30%
Governmental obligation	5%	13%	9%
Increase range	26%	13%	20%
Resources			
Services	79%	50%	65%
Financial support	16%	5%	11%
Market access	24%	8%	11%
Logistics	11%	3%	7%
Contacts	50%	24%	37%
Political support	8%	3%	6%
Personnel	13%	8%	11%
Knowledge	76%	50%	63%
Safety	11%	8%	10%
Division of work	13%	16%	15%

Table 3 shows, within collaborative networks of elderly care organizations, the three foremost reasons for collaboration (C1,C2) are quality of services (53%), specialized services and efficient use of resources (42%) and more services, knowledge and professional development (30%). Thus, it can be stated that the reasons of elderly care organization to collaborate are mainly focused around service delivery. However, it is interesting that reasons to collaborate like risk reduction (4%), lobby (7%) and governmental obligation (9%) are far less mentioned. Besides the aforementioned reasons, the three foremost resources extracted from the collaboration (C1,C2) are: services (65%), knowledge (63%) and contacts (37%). Somewhat in line with the three least mentioned reasons, the least extracted resources look quite similar. Namely, political support (6%), logistics (7%) and safety (10%).

4.2 Technologies and technological innovation activities

This section is provided regarding the developed, adopted and implemented technologies within collaborative networks. The descriptive sub-question that will be answered in the paragraph is: 'W*hat technologies are developed, adopted or implemented among collaborative networks of elderly care organizations?*'. In Table D1 (Appendix D), a detailed overview is provided with specific names of technologies that are collaboratively established by elderly care organizations. Table D1 in appendix D provides more specific insights about technologies. However, in this paragraph the focus will be on the function and type of technology in relation to the technological innovation activities. In table 4 the descriptive statistics are presented.

Table 4: *Descriptive statistics (frequencies) of the three technological innovation activities and the function of their technologies in the two most important collaborative networks (C1,C2)*

	Technological innovation activities			**Total technologies (%)**
	Developed Sum (C1,C2)	**Adopted Sum (C1,C2)**	**Implemented Sum (C1,C2)**	
Function of technology				
Safety client	12	24	22	58 (27%)
Daily support	10	16	13	39 (18%)
Cognitive support	2	6	6	14 (7%)
Recreational purposes	0	4	6	10 (5%)
Communication & Connectivity	5	16	16	37 (17%)
Care administration	6	11	14	31 (14%)
Educational purpose	5	3	3	11 (5%)
Organizational administration	4	5	6	15 (7%)
Total activities with percentages (C1,C2)	44 (20%)	85 (40%)	86 (40%)	215 (100%)

Overall, Table 4 shows that the three most common collaboratively established functions of technologies are safety of client (27%), daily support (18%) and communication and connectivity (17%). First, the least common established technologies have the function of recreation and education (both 5%). Looking at the technological innovation activities, the three most common functions with regard to development are safety of client are safety of client (12), daily support (10) and care administration (6). Secondly, the three foremost functions regarding adoption are safety (24), daily support (16) and communication and connectivity (16) Lastly, the three most common functions for implementation are safety (22), communication and connectivity (16) and care administration (14).

Table 5: Descriptive statistics (f*requencies) of the three technological innovation activities and type of their technologies in the two most important collaborative networks (C1,C2)*

	Technological innovation activities			**Total technologies (%)**
	Developed Sum (C1,C2)	**Adopted Sum (C1,C2)**	**Implemented Sum (C1,C2)**	
Type of technology				
Access sensors	6	16	15	37 (19%)
Motion sensors	6	14	13	34 (18%)
GPS/Localisation	3	6	8	17 (9%)
Biosensors	0	3	2	5 (3%)
Telemedicine	1	3	4	8 (4%)
Robotics	0	2	2	4 (2%)
VR	1	2	2	5 (3%)
(Online) communication	6	16	14	36 (19%)
Hardware	4	11	9	24 (13%)
E-health	3	4	8	15 (8%)
Cognition training	0	1	1	2 (1%)
Mobility	1	1	2	4 (2%)
Total activities in percentages (C1,C2)	31 (16%)	79 (41%)	81 (43%)	191 (100%)

Table 5 presents frequencies of the type of technology in relation to technological innovation activities. In general, the three most established types of technologies are access technologies (19%), communication and connectivity technologies (19%) and motion technologies (18%). The three least established type of technologies are cognition training technologies (1%), robotics (2%) and mobility technologies (2%). When analysing the technologies in table 5 per technological innovation activity, table 5 shows that the three foremost type of technologies do not differ between the technological innovation activities. For all three technological innovation activities, the three common established technologies are access technologies, (online) communication technologies and motion technologies.

Referring back to the sub-question two remarkable findings can be concluded. First, the three foremost type of technologies do not differ between the technological innovation activities. Second, it can be seen that the function of technologies in the area of communication are less important for development activities compared to other technologies. For adoption activities, technologies in the function area of care administration are less important compared to the other activities. For implementation activities, technologies in the function area of daily support are less important compared to other activities.

4.3 Characteristics of collaborative networks and technologies

In this section more information is given about the relation between the characteristics of collaborative networks and technologies. The sub-question that will be answered here is: '*How are the characteristics of collaborative networks related to technologies in elderly care?*'. Deriving from the results from the result sections 4.1 and 4.2, the focus will be on technologies with the function of daily support, communication and connectivity and care administration. Next to this, the relation between characteristics of collaboration and access sensors, motion sensors and (online) communication technologies will be further elaborated.

Table 6: *Cross table of the three most important functions of technologies with the means of characteristics of collaborative networks of elderly care organizations in the two most important collaborative networks (C1,C2)*

	Function of technologies		
	Daily support	**Communication & Connectivity**	**Care administration**
	Mean (C1,C2)	**Mean (C1,C2)**	**Mean (C1, C2)**
Variable			
*Involvement of different types of partners**			
Educational	13%	9%	22%
Individuals	45%	39%	15%
Public	24%	14%	28%
Private	49%	50%	61%
Health	54%	70%	59%
Partner diversity	2	2	2
Number of partners	8	5	8
Contact frequency	3	2	3
Geographical scope	4	4	4

**Note:* Categorical variables are shown in percentages in Table 6

In Table 6 the characteristics of collaborative networks in relation to the function of technologies are shown. Because geographical scope (provincial scope) and partner diversity (2 different partners) do not differ between the functions of technologies this will not be further elaborated in the result section.

First, analysing the type of partners in Table 5, the three foremost type of partners within collaborative networks which establish technologies in the area of daily support and communication and connectivity are health organizations, private organizations and individuals. However, public organizations are found to be more important for care administration. Besides this, care administration was found less important in adoption activities (section 4.2). Consequently, the finding suggest that public partners are less important in the adoption activities compared to the other activities.

Next, Table 5, which indicates that the number of partners of communication and connectivity technologies is 5 compared to the other technologies which is 8. Relating this to the outcomes of

section 4.2, this suggests that in development innovation activities the number of partners is higher due to the fact that technologies with the function of communication and connectivity are less developed in those networks as compared to the other activities.

Lastly, contact frequency is found to be less (2: few times a year) in communication and connectivity technologies compared to the other function of technologies (3: monthly). Two explanations can be given for this. The first is that technologies with the function of communication and connectivity are easier to establish within a collaboration which result in having less contact. Second, in the development activities less contact is desirable than other activities. This is contrary to the expectations that in the development activities strong ties are more beneficial. Further analysing this will provide more understanding about this relationship.

Table 7a: *Cross table of the average of the three most important functions of technologies with reasons for collaboration in the two most important collaborative networks (C1,C2)*

	Function of technology		
	Daily support	**Communication & Connectivity**	**Care administration**
	Mean (C1,C2)	**Mean (C1,C2)**	**Mean (C1, C2)**
Reasons for collaboration			
Specialized services	61%	57%	46%
More services	45%	34%	42%
Quality of services	54%	57%	42%
Efficiency of resources	53%	52%	61%
Solving collective action problems	22%	30%	27%
Risk	6%	7%	0%
Lobby	7%	0%	11%
Knowledge	37%	37%	35%
Organizational development	32%	40%	47%
Governmental obligation	9%	15%	0%
Increase range	25%	20%	28%

Table 7b: *Cross table of the average of the three most important functions of technologies with resources from collaborative networks in the two most important collaborative networks (C1,C2)*

	Function of technology		
	Daily support	**Communication & Connectivity**	**Care administration**
	Mean (C1,C2)	**Mean (C1,C2)**	**Mean (C1, C2)**
Resources from collaboration			
Services	79%	50%	84%
Financial support	10%	0%	14%
Access to markets	15%	19%	23%
Logistics	6%	7%	7%
Contacts	47%	40%	40%
Political support	7%	0%	11%
Personnel	10%	12%	8%
Knowledge	70%	67%	70%
Security	6%	9%	17%
Division of work	22%	20%	20%

Table 7a and Table 7b shows the function of technologies in relation with the reasons for collaboration and resources derived from those collaborations. First, collaborative networks that establish daily support technologies collaborate because they can foremost provide specialized services (61%), quality of services (54%) and efficiency of resources (53%). The most common resources extracted are services (79%), knowledge (70%) and contacts (43%). Second, collaborative networks that establish technologies in the area function of communication and connectivity collaborate because of specialized services (57%), quality of services (57%) and efficiency of resources (52%). The most common resources extracted are knowledge (70%), services (50%) and contacts (40%). Lastly, collaborative networks that establish technologies in the function area of care administration collaborate because they can foremost provide are efficient in the use of resources (61%), specialized services (46%) and quality of services/more services (42%). The most common resources extracted are services (84%), knowledge (70%) and contacts (40%). The least mentioned reasons for collaborating to establish these technologies are risk reduction, lobby and governmental obligation. However, governmental obligation (15%) is found to be an important reason when establishing a communication and connectivity technology compared to other technologies.

Analysing the least mentioned resources extracted, the most remarkable finding is that for technologies in the function area of communication and connectivity no political and financial

support is withdrawn compared to the other technologies. Comparing this result to Table 4, which shows this function of technology is least developed compared to adopted and implemented, the finding suggest that in the development activity, political and financial support is more apparent.

Table 8: *Cross table of the three most important type of technologies with the means of characteristics of collaborative networks of elderly care organizations in the two most important collaborative networks (C1,C2)*

	Type of technology		
	Access sensors	**Motion sensors**	**(Online)communication**
	Mean (C1,C2)	**Mean (C1,C2)**	**Mean (C1,C2)**
Variable			
*Involvement of different types of partners**			
Educational	17%	19%	12%
Individuals	46%	36%	25%
Public	13%	4%	25%
Private	59%	65%	52%
Health	53%	57%	62%
Partner diversity	2	2	2
Persons	6	6	4
Contact frequency	3	3	3
Geographical scope	4	4	4

**Note:* Categorical variables are shown in percentages in Table 8

Table 8 shows the most important types of technologies related to characteristics of collaborative networks. Communication technologies are found to be established with less persons (4) compared to access and motion sensors (6). This suggest less persons are needed to establish communication technologies. The three most common partners of the type of technologies are private organizations, health organizations and individuals. The result shows that the type of partners is not dissimilar between the type of technologies.

Table 9a: *Cross table of the average of the three most important types of technologies with reasons for collaboration in the two most important collaborative networks (C1,C2)*

	Type of technologies		
	Access sensors	**Motion sensors**	**(Online)communication**
	Mean (C1,C2)	**Mean (C1,C2)**	**Mean (C1,C2)**
Reasons for collaboration			
Specialized services	42%	36%	59%
More services	33%	29%	27%
Quality of services	67%	60%	57%
Efficiency of resources	58%	69%	35%
Solving collective action problems	11%	21%	29%
Risk	4%	0%	4%
Lobby	4%	0%	4%
Knowledge	33%	48%	27%
Organizational development	45%	40%	35%
Governmental obligation	10%	0%	5%
Increase range	20%	19%	19%

Table 9a shows the reasons to collaborative for the three most important type of technologies. The main results from Table 9a are that a substantial reason to collaborate to produce motion sensors is the gaining of knowledge (48%) compared to the other type of technologies. However, for motion sensors risk, lobby and governmental obligations are not reasons to collaborate to establish motion sensors (0%) as compared with the other technologies. Another remarkable findings from Table 9a are that providing specialized services is more important for (online) communication technologies (59%), providing more services (33%) is more important for access sensor technologies and providing specialized services (36%) are found not that be important for motion sensors.

Table 9b: *Cross table of the average of the three most important types of technologies with resources from collaboration in the two most important collaborative networks (C1,C2)*

	Type of technologies		
	Access sensors Mean (C1,C2)	**Motion sensors Mean (C1,C2)**	**(Online)communication Mean (C1,C2)**
Resources from collaboration			
Services	56%	63%	77%
Financial support	14%	9%	4%
Access to markets	22%	28%	14%
Logistics	7%	9%	12%
Contacts	33%	38%	47%
Political support	4%	0%	4%
Personnel	4%	4%	15%
Knowledge	59%	75%	59%
Security	10%	4%	17%
Division of work	13%	15%	10%

Table 9b shows the resources extracted from collaborations for the three most important types of technologies. The main results are that for access sensors financial support (14%) is better provided compared to the other type of technologies. One other remarkable finding is that security (17%) is derived as a resource by establishing (online)communication technologies.

4.4 Characteristics of collaborative networks and technological innovation activities

We use the results of the descriptive analyses from previous sections, to explore whether the theoretical hypotheses hold. It is an exploration rather than a strong test, because of the relative low N in this study. The main research question is aimed to be answered: '*To what extent are characteristics of collaborative networks among Dutch elderly care organizations associated with technological innovation activities?'*. In Tables 10, 11a and 11b both mean of collaboration 1 and 2 are given with their mean of the sum. This because it provides a detailed description about the differences between the two collaborative networks in order to explain the outcomes of the developed hypotheses more explicitly.

Table 10: *Cross table of the means of technological innovation activities and characteristics of collaborative networks of the two most important networks (C1,C2)*

	Technological innovation activities					
	Developed		**Adopted**		**Implemented**	
	C1	**C2**	**C1**	**C2**	**C1**	**C2**
Variable						
*Involvement of different types of partners**						
Educational partners	45%	20% (33%)	11%	20% (16%)	16%	14% (15%)
Individuals	36%	30% (33%)	42%	33% (37%)	37%	29% (33%)
Public partners	27%	20% (24%)	11%	20% (16%)	5%	21% (13%)
Private partners	64%	50% (57%)	47%	53% (50%)	63%	71% (67%)
Health partners	55%	50% (53%)	68%	53% (60%)	63%	50% (57%)
Partner diversity	2,2	1,7 (2)	2	2,1 (2)	1,9	2 (2)
Number of partners	7,2	5 (6)	9,9	3,3 (7)	4,4	3,9 (4)
Geographical scope	4,6	4 (4)	3,4	3,9 (4)	3,7	4,2 (4)
Contact frequency	2,9	3 (3)	2,8	2,9 (1)	2,7	2,6 (3)

**Note:* Categorical variables are shown in percentages in Table 10

First of all, looking at Table 10, in all three technological innovation activities the partner diversity consists on average of two type of partners resulting in a partial rejection of all three hypotheses. More specifically, Table 10 does not report a difference between the three innovation activities in their partner diversity (C1,C2: μ=2). Because of this, the technological innovation activities are somewhat similar in their partner diversity decisions. Similar results can be found in Tables 2, 6 and 8 in earlier sections. In the methodology section a partner diversity of two indicate a low partner diversity and this can be found in the three technological innovation activities.

Looking at the overall results of Table 10, comparing the number of partners, there are less people involved in the implementation activity (C1,C2: μ=4) compared to the development and adoption activities (C1,C2: μ=6/7). The result suggests that in the implementation activity strong ties are more prevalent compared to the development and adoption activities. Contact frequency in the adoption activity (C1,C2: μ=1) is less frequent than in the development and implementation activities (C1,C2: μ=3). The finding suggest that in the adoption activity weak ties are more common compared to development and implementation activities.

Geographical scope suggest not the be apparent for technological innovation to relate to strong ties because in all three activities the provincial scope is applicable (C1+C2: μ=4). The score of 4 is related as earlier conceptualized as the availability of weak ties.

Relating these findings to the hypotheses, the first hypothesis (1a): '*Collaborative networks of elderly care organizations with a high partner diversity and strong ties are more involved with the **development** of technological innovations as compared to their adoption or implementation activities*' is rejected. First, partner diversity in development activities is found to be low (C1: μ=2,2; C2: μ=1,7) and geographical scope is (C1: μ=4,6; C2: μ=4) which suggest having weak ties. Second, from theory it is expected that less partners are involved compared to the other activities. However comparing adoption (C1,C2: μ=7) and implementation (C1,C2: μ=4) activities, the number of partners is comparable with the number of partners in the adoption activities (C1,C2: μ=6). In order to support the hypothesis the number of partners have to be comparable with the implementation activities since the hypothesis expect strong ties to be prevalent. Lastly, in the development activities, the variable contact frequency (C1: μ=2,9; C2: μ=3) show monthly contact which is similar to implementation activities whereas contact frequency for adoption is yearly (C1,C2: μ=1). The result indicate that for contact frequency the strong ties are available in development and implementation activities. However, since the outcomes did not correspond to the theory, hypothesis 1a is rejected.

Next, the second hypothesis: '*Collaborative networks of elderly care organizations with a high partner diversity and weak ties are more involved with the **adoption** of technological innovations as compared to their development or implementation activities* is partly supported. First, partner diversity has been found low (C1,C2: μ=2) which was not expected from theory. Taking the other variables in consideration like geographical scope (C1,C2: μ=4) the result suggest weak ties. Moreover, the number of partners within adoption activities (C1 ,C2: μ=7) is higher than in other innovation activities. Deriving from the conceptualization of number of partners is that more than 5 people indicate a high number of persons. For weak ties, this is expected to be prevalent. Also, the frequency of contact is yearly (C1,C2: μ=1) compared to the other innovation activities. The other innovation activities have on average monthly contact. This way, hypothesis 2a is partly supported.

Third, the hypothesis: '*Collaborative networks of elderly care organizations with a low partner diversity and strong ties are more involved with the **implementation** of technological innovations as compared to their development or adoption activities*' is partly supported. First, partner diversity is low (C1,C2: μ=2). Second, the number of partners (C1+C2: μ=4) is lower as compared to the other activities (C1+C2: μ=6/7) which indicate strong ties. Besides this, it turns out that the frequency of contact (C1+C2: μ=3) is monthly in the implementation activities just as in the development activities (C1+C2: μ=3)

compared to yearly contact in adoption activities (C1+C2: μ=1). However the hypothesis is partly supported since the high geographical scope (C1,C2: μ=4) relate to weak ties instead of strong ties.

Table 11a: *Cross table of the average of the three technological innovations activities with reasons for collaboration in the two most important collaborative networks (C1,C2)*

	Technological innovation activities					
	Developed		**Adopted**		**Implemented**	
	C1	**C2**	**C1**	**C2**	**C1**	**C2**
Reasons for collaboration						
Specialized services	55%	60% (58%)	47%	47% (47%)	42%	43% (43%)
More services	36%	30% (33%)[b]	37%	20% (29%)	32%	29% (30%)
Quality of services	73%	70% (72%)	58%	60% (59%)	63%	57% (60%)
Efficiency of resources	64%	70% (67%)	37%	67% (52%)	42%	64% (53%)
Solving collective action problems	36%	30% (33%)	21%	33% (27%)	16%	29% (23%)
Risk	0%	0% (0%)	5%	0% (3%)	5%	0% (3%)
Lobby	9%	0% (9%)	5%	0% (3%)	11%	7% (9%)
Knowledge	55%	40% (47%)	21%	47% (34%)	37%	21% (29%)
Organizational development	36%	40% (38%)	26%	47% (37%)	42%	57% (50%)
Governmental obligation	9%	30% (19%)	0%	7% (4%)	5%	21% (13%)
Increase range	36%	10% (23%)	21%	13% (17%)	21%	14% (18%)

Table 11a shows the reasons for collaboration per technological innovation activity. Table 11a is analysed by comparing the three foremost reasons for collaboration per technological innovation activity. First, the three most common reasons for collaboration in the development activity are quality of services (79%), efficiency of resources (67%) and specialized services (58%). Second, for adoption activity these are quality of services (59%), efficiency of resources (52%) and specialized services (47%). Third, the three foremost reasons for collaboration in the implementation activity are quality of services (60%),

efficiency of resources (53%) and organizational development (50%). Deriving from these findings, quality of services and efficiency of resources is found to be important in all three innovation activities. However, organizational development is found to be more important in the implementation activity compared to the development and adoption activities. In the development and adoption activities providing specialized services is found to be a more important reason to collaborate than in the implementation activities. A remarkable finding is the least common reason for collaboration in adoption activities is governmental obligation (4%) compared to development (19%) and implementation (13%) activities.

Table 11b: *Cross table of the average of the three technological innovation activities with resources from collaboration in the two most important collaborative networks (C1,C2)*

	Technological innovation activities					
	Developed		**Adopted**		**Implemented**	
	C1	**C2**	**C1**	**C2**	**C1**	**C2**
Resources from collaboration						
Services	55%	70% (63%)	89%	60% (75%)	79%	79% (79%)
Financial support	27%	0% (14%)	5%	0% (3%)	5%	7% (6%)
Access to markets	36%	0% (18%)	26%	13% (20%)	32%	7% (20%)
Logistics	0%	0% (0%)	21%	7% (14%)	5%	7% (6%)
Contacts	64%	10% (37%)	47%	27% (37%)	42%	21% (32%)
Political support	9%	0% (5%)	0%	0% (0%)	5%	7% (6%)
Personnel	18%	20% (19%)	11%	13% (12%)	0%	0% (0%)
Knowledge	91%	90% (91%)	74%	60% (67%)	79%	57% (68%)
Security	18%	0% (9%)	5%	20% (13%)	0%	21% (11%)
Division of work	9%	30% (20%)	16%	13% (15%)	5%	14% (10%)

Table 11b is analysed by comparing the resources from collaboration per technological innovation activity. First, the three most common resources from collaboration in the development activities are knowledge (91%), services (63%) and contacts (37%). Second, for adoption activities these are services (75%), knowledge (67%) and contacts (37%). Third, the three foremost resources from collaboration in the implementation activities are services (79%), knowledge (68%) and contacts (32%). In all the three innovation activities, services, contacts and knowledge are the most important resources extracted from

collaboration. Knowledge is found to be more prevalent extracted from development activities compared to other activities. In the other activities, services are found the be the main resource that is extracted. Before elaborating on the hypotheses, one major outcome was that the type of technologies does not differ between the technological innovations activities. Thus, the focus will be on the function of technologies due to the fact these slightly differ between the technological innovation activities. This way, the hypotheses are answered by referring to the functions of technologies and the reasons to collaborate.

The first hypothesis (1b): '*Technologies **developed** in collaborative networks of elderly care organizations are more traditional than technologies adopted or implemented*' is rejected. First, Tables 4 and 5 in section 4.2 shows that development activities (20%) are less frequent than in other activities (40%). The result imply that in development activities more risks are experienced as compared to other activities. Contradictory, Table 11b presents that risk reduction (0%) is not a reason to collaborate in the development activities as compared to the adoption and implementation activities (3%). In section 4.2 it was found that technologies with the function of communication and connectivity are less important than in other innovation activities. This however does not indicate if people in the development activities establish more traditional technologies. Table 11a presents, looking at the top three, that the main reason to collaborate for developing technological innovations as compared to implementation activity is providing specialized services. However, the top three of reasons for development activities is the same for the adoption activities. A side note is that the two foremost reasons to collaborate in the three technological innovation activities are quality of services and efficiency of resources. So, this is applicable to all technological innovation activities. From theory it was expected that quality of services would be more important in development activities than other technological innovation activities. Since this is not true, there is no substantial indication that developed technologies are more traditional as compared to other innovation activities.

The second hypothesis (2b): '*Technologies **adopted** in collaborative networks of elderly care organizations are more advanced than technologies developed or implemented*' is rejected. First, technologies with the function of care administration was found to be less important as compared to other technological innovation activities. This outcome however does not indicate that technologies with the function of care administration are advanced or not. Second, for adoption activities the three foremost reasons to collaborate for technological innovation are the same as for the development activities. This way, do not differ between the technological innovation activities. Therefore, hypothesis 2b is rejected.

The last hypothesis (3b): '*Technologies **implemented** in collaborative networks of elderly care organizations are relatively cost-effective than technologies developed or adopted'* is rejected. First, in the

implementation activities technologies with the function of daily support are less important as compared to the other technological innovation activities. A reason for this could be that these technologies are still in their development or adoption phase. Second, for implementation activities, comparing the top three of reasons, the main reason why people in the implementation activity collaborate compared to the other technological innovation activities is organizational development. From theory it was expected that a reasons like providing more services would be more important in this activity. Organizational development however give some indication or professionalization of the organization which can be cost-effective and can be supported by implementing technological innovation. From the current results a substantial conclusion could not be given. Due to this, hypothesis 3b is rejected.

5. Conclusion and Discussion

The thesis explored the characteristics of collaborative networks of 38 Dutch elderly care organizations in order to establish technological innovations. In the thesis the differences between technological innovations activities were investigated to understand how and why elderly care organizations collaborate to establish technologies. Regarding the theory of strong and weak ties with support of partner diversity the characteristics of those collaborative networks of Dutch elderly care organizations were explored. The theory can support the approach towards collaborative innovation in hybrid organizations such as elderly care organizations. Besides this, some expectations about technologies were formulated in hypotheses 1b, 2b and 3b. More understanding of these established technologies can reveal the current status of technological innovation within the innovation activities. This way, scientific as well as practical implications could be given.

The main question of the thesis is: '*To what extent are characteristics of collaborative networks among Dutch elderly care organizations associated with technological innovation activities*'. Overall, elderly care organization collaborate in the three technological innovation activities mainly with two type of partners consisting of mainly health and private partners. First, in the development activities a low partner diversity and indications of weak ties is reported. The contact frequency in the development activities however suggested strong ties. Also in the development activities technologies with the function of connectivity and communication is found to be less important as compared to other activities. Second, in adoption activities weak ties were reported but a low partner diversity is apparent. In this activity, technologies with the function of care administration is less important. Next, in the development activities a high partner diversity is available with strong ties except for

geographical scope. And technologies with the function of daily support was less important compared to other technological innovations activities.

The limitations of the thesis are broad since the thesis reported a low number of respondents (N=38). This way, generalization to the population of elderly care organizations is not fully reliable. In addition, in collaboration 2 less respondents were reported, compared to collaboration 1 (Appendix A). This reason, collaboration 1 and collaboration 2 were considered separately in the result section. Second, the survey allowed multiple choice for the answering of the questions. This made merging answers impossible. Consequently, the significance levels could not be given between the technological innovations activities which resulted in that no significant differences between groups could be derived. This way, the results of the hypotheses are not statistically confident. Besides all the limitations, for explorational purposes the research was valuable and provided understanding about collaborative networks among elderly care organizations for technological innovation. However, much research gaps still remain. In addition, the research gave a good indication on how and why elderly care organizations collaborate to establish technological innovations. Future research can use the same questionnaire about collaborative technological innovation in other hybrid organizations. Consequently, differences between hybrid organizations and their collaborative innovation could be compared for more effective policy towards stimulating collaborative technological innovation. With more effective policy, vulnerable people in society can be better supported with the upcoming demographic changes.

For the development of technological innovations the following can be discussed. From theory it is suggested that a high partner diversity and strong ties can enhance the development of technological innovations (Hansen & Villadsen, 2017; Bekkers, Tummers & Voorberg, 2013; Granovetter, 1985; March, 1991. But the latter was not completely reported from the results except for more intensive contact frequency as compared to the other activities. The side note from Bekkers, Tummers and Voorberg (2013) supported that also weak ties can be beneficial for developing technological innovations. Since the thesis reported an outcome which not correspond with the hypothesis further research is necessary to understand the development of technological innovations in elderly care organizations. Consequently, focusing on all the stages in the development of technological innovations and the type of collaborative behaviour (e.g. weak ties or strong ties) can enhance the understanding which behaviour is most effective.

The adoption and implementation activities showed a more positive outcome relating to the expectations from theory. Based on the theory a high partner diversity can enhance the adoption of technological innovations (Hansen & Villadsen, 2017; Termeer & Nooteboom, 2014). Elderly care organizations could try to collaborate with more different partners. Collaborating with educational and public partners are far less reported than with health or private partners. Also in the adoption activity,

governmental obligation was not a reason to adopt technologies but also financial support was not extracted from adopting. At the same time, adopting technologies can be effective since more information is available how to put the technological innovation into use within the organization. With the support of governmental organizations, elderly care organizations could be assisted to enhance the effectiveness of adopting technological innovations.

In the implementation activity, the geographical scope of the collaboration could be closer to increase the efficiency of implementation of technological innovations. The suggestion is based on the theory which state that a low partner diversity and strong ties can enhance the implementation of innovations (Hansen & Villadsen, 2017; Granovetter, 1985; Termeer & Nooteboom, 2014).

Overall, the type of technologies established in the thee innovation activities were quite similar. Besides this, far less advanced technologies were reported such as robotics which can serve many functions. The more general technologies like access and motion sensors were found to be more prevalent and financial support could be provided. The outcomes of the research indicate that collaborative innovation within elderly care organizations can be far more improved. Both elderly care organizations and governments could collaborate more intensively to increase the effectiveness of collaborative innovation which leads to a better performance. Together they can provide strategies how a desired technological innovation can be most effectively collaboratively established. These results indicate that further scientific research towards collaborative innovations remains to be done. The current thesis provided a start with providing more scientific knowledge about collaborative innovation and revealed how elderly care organizations, and possibly governments, could improve their strategies to establish technological innovations. This way, the more vulnerable people like the elderly can be better supported in the future.

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7. Appendices

Appendix A

Missing Value Analysis

After the preparation of the data which entails the construction of the independent, dependent and control variables a Missing Value Analysis (MVA) was conducted. Based on the structure of the original questionnaire which started with a general question about the respondent (age and gender) this was the starting point of the MVA. There were some obliged questions (6,14,22,33) within the questionnaire in Qualtrics in order to finish the survey. However, these questions were textual which create string variables. String variables could not be analysis through a MVA. In that matter, first the respondents who did not answer question 14 were excluded and later on the respondents who did not answer question 22. In addition, based on logic the textual question 14 and 22 were automatic recoded and the dataset was extra checked so relevant information stays included. The check included the answering behaviour of respondents who answered with for instance –, no or 'don't know'. In case of the detection of a pattern in which a respondent did not answered or had given no relevant question these respondents were excluded. Table 3 gives as summary of the amount of respondents who filled in the survey and the missing values. Concluded, within this research 38 cases are being analysed.

Table A1: *Amount of respondents within the dataset and missing values*

	Before filter variable(s)		**After filter variable Q14 + Q22 and survey logic**	
Variables	**N**	**Missing**	**N**	**Missing**
Gender	144	76	38	0
Age	144	76	38	0
Persons collaboration 1	58	162	36	2
Duration collaboration 1	59	161	37	1
Persons collaboration 2	45	175	34	4
Duration collaboration 2	46	174	35	3

Due to the fact some respondents did not answered later questions but the first information was relevant, data was imputed with 99 for ordinal variables or 0 for some categorical variables. The reason for this is that the data remains relevant for analysing without losing relevant information.

Appendix B

Dutch questionnaire elderly care organizations

Introductie van de vragenlijst: *De afdeling Bestuurskunde van de Universiteit Twente doet onderzoek onder leiding van prof. dr. R. Torenvlied naar de factoren die bijdragen aan de (succesvolle) implementatie en/of ontwikkeling van technologische innovaties in de ouderenzorg. Het onderzoek vindt plaats binnen een door de Koninklijke Academie van Wetenschappen (KNAW) gefinancierd onderzoek naar innovaties. In dit onderzoek wordt gekeken naar samenwerkingsverbanden die ouderenzorginstellingen aangaan om technologische innovaties te realiseren. Dit gegeven is op dit moment zeer relevant gezien de huidige WMO-condities waarin ouderenzorginstellingen vaak genoodzaakt zijn om samen te werken. Met de resultaten van dit onderzoek kunnen wij het veld van ouderenzorginstellingen (verder) helpen beschikbare middelen effectief te gebruiken omdat inzicht wordt verkregen in welke factoren en/of partners nodig zijn om innovaties te realiseren.*

Het invullen van deze vragenlijst kost u 20 minuten. De door u ingevulde antwoorden zullen anoniem en vertrouwelijk verwerkt worden. Als u vragen hebt over de vragenlijst kunt u een e-mail sturen naar: s.coenen@student.utwente.nl.

Wij stellen uw input zeer op prijs!

1. <u>Algemene informatie respondenten</u>

1. **Wat is uw geslacht?**
   Man □ Vrouw □ Anders namelijk…
2. **Wat is uw leeftijd?** …
3. **Hoeveel jaar werkt u in de ouderenzorg?** …
4. **Hoelang werkt u op deze positie in uw instellings(locatie)?** (in jaren) …
5. **Hoeveel uur per week besteedt u aan werkzaamheden in deze functie?**(in uren)…
6. **Kunt u een schatting geven van het aantal werknemers waaraan u direct leiding geeft?…**
7. **Hoeveel cliënten heeft de instellings(locatie) waarvoor u verantwoordelijk bent op dit moment**?…
8. **Wat voor soort zorg biedt de instellings(locatie) waarvoor u verantwoordelijk?**
   (Meerdere antwoorden mogelijk)
   Wijkverpleging □ Intramurale verzorging □ Intramurale verpleging □ Revalidatie □ Huishoudelijke hulp □Anders namelijk…

2. Samenwerkingsverbanden om technologische innovaties te realiseren deel 1

Kunt u de twee belangrijkste samenwerkingsverbanden noemen waarmee u één of meerdere technologische innovaties heeft geadopteerd, ontwikkeld en/of geïmplementeerd?

1. **Naam samenwerkingsverband 1**: ……

2. **Naam technologische innovatie:** …….

3. **Kruis aan type technologie:**
   - ☐ (Draadloze) toegang sensortechnologie
   - ☐ (Draadloze) beweging sensortechnologie
   - ☐ GPS/lokalisatie technologie
   - ☐ Biosensortechnologie (bijv. hartslagband)
   - ☐ Telemedicine (bijv. automatische medicijndispenser)
   - ☐ Robotica
   - ☐ Virtual reality technologie
   - ☐ (Online) communicatie technologie
   - ☐ Hardware technologie (bijv. Tablets)
   - ☐ E-health technologie (bijv. OMAHA systeem)
   - ☐ Cognitie training technologie
   - ☐ Mobiliteit technologie (bijv. traplift)
   - ☐ Anders namelijk…)

4. **Kruis aan het doel van de technologische innovatie**:
   - ☐ Veiligheid van de cliënt
   - ☐ Ondersteuning in dagelijkse activiteiten cliënt
   - ☐ Cognitieve ondersteuning cliënt
   - ☐ Recreationele doeleinden cliënt
   - ☐ Communicatie en connectiviteit cliënt
   - ☐ Zorgverlening en cliënt gerelateerde administratie
   - ☐ Educatie zorgverleners
   - ☐ Instellingsadminstratie
   - ☐ Anders namelijk…

5. **(Trapsgewijs antwoord vraag 2) Heeft deze technologische innovatie in dit samenwerkingsverband ontwikkeld, geadopteerd of geïmplementeerd?**
   - ☐ Ontwikkeld
   - ☐ Geadopteerd
   - ☐ Geïmplementeerd
   - ☐ Ontwikkeld en geïmplementeerd
   - ☐ Geadopteerd en geïmplementeerd
   - ☐ Geen van alle opties namelijk….

6. **(Trapsgewijs antwoord vraag 1) Hoeveel individuen zitten in dit samenwerkingsverband?** .....

7. **(Trapsgewijs antwoord vraag 1) Kunt u aangeven welk type partners in dit samenwerkingsverband zitten?** (meerdere antwoorden mogelijk)
   - Adviesbureau
   - Basis-en middelbare school
   - Burgers
   - Brancheverenigingen (bv. ActiZ)
   - Cliënten en/of cliëntenraad
   - Fysiotherapie of revalidatiecentrum
   - Gemeente
   - Kennisinstituut (universiteit, hogeschool, mbo-college).
   - Lokale en/of nationale politici
   - Ouderenzorginstelling
   - Provincie
   - Nationale overheid
   - Non-profit organisatie
   - Private organisatie
   - Productontwikkelaar
   - Politie
   - Woningcorporatie
   - Ziekenhuizen
   - Zorgmedewerkers
   - Zorgverzekering
   - Anders namelijk...

8. **(Trapsgewijs antwoord vraag 1) Kunt u aangeven op welk niveau dit samenwerkingsverband van toepassing is?**
   - Buurtniveau
   - Gemeentelijk
   - Regionaal
   - Provinciaal
   - Landelijk
   - Internationaal

9. **(Trapsgewijs antwoord vraag 1) Kunt u een inschatting geven hoe vaak u contact heeft met alle leden in dit samenwerkingsverband?**
   - Dagelijks
   - 2/3 keer per week
   - 3/4 keer per week
   - Wekelijks

- ☐ Om de twee weken
- ☐ Maandelijks
- ☐ Een paar keer per jaar
- ☐ Jaarlijks
- ☐ Nooit

10. **(Trapsgewijs antwoord vraag 1) Wat is de <u>voornaamste</u> reden om dit samenwerkingsverband aan te gaan?**
    - ☐ Gespecialiseerde diensten aan kunnen bieden
    - ☐ Meer diensten kunnen leveren
    - ☐ De kwaliteit van diensten verhogen
    - ☐ Efficiëntere benutting van beschikbare middelen
    - ☐ Collectieve actie problemen kunnen oplossen
    - ☐ Risico spreiding
    - ☐ Lobby
    - ☐ Kennis verwerven
    - ☐ Organisatieontwikkeling
    - ☐ Verplichting vanuit de overheid
    - ☐ Het bereik vergroten
    - ☐ Anders namelijk ….

11. **(Trapsgewijs antwoord vraag 1) Welk <u>belangrijkste</u> middel kan uit dit samenwerkingsverband verworven worden?**
    - ☐ Diensten
    - ☐ Financiële ondersteuning
    - ☐ Toegang tot specifieke markten
    - ☐ Logistiek
    - ☐ Contacten
    - ☐ Politieke ondersteuning
    - ☐ Personeel
    - ☐ Kennis
    - ☐ Veiligheid (bv. financiële veiligheid)
    - ☐ Verdeling van werk
    - ☐ Anders namelijk:……

3. <u>Samenwerkingsverbanden om technologische innovaties te realiseren deel 2</u>

Kunt u de twee belangrijkste samenwerkingsverbanden noemen waarmee u één of meerdere technologische innovaties heeft geadopteerd, ontwikkeld en/of geïmplementeerd?

12. **Naam samenwerkingsverband 2**: …

13. **Naam technologische innovatie:** …

14. **Kruis aan type technologie:**
    - □ (Draadloze) toegang sensortechnologie
    - □ (Draadloze) beweging sensortechnologie
    - □ GPS/lokalisatie technologie
    - □ Biosensortechnologie (bijv. hartslagband)
    - □ Telemedicine (bijv. automatische medicijndispenser)
    - □ Robotica
    - □ Virtual reality technologie
    - □ (Online) communicatie technologie
    - □ Hardware technologie (bijv. Tablets)
    - □ E-health technologie (bijv. OMAHA systeem)
    - □ Cognitie training technologie
    - □ Mobiliteit technologie (bijv. traplift)
    - □ Anders namelijk…

15. **Kruis het doel aan van de technologische innovatie**:
    - □ Veiligheid van de cliënt
    - □ Ondersteuning in dagelijkse activiteiten cliënt
    - □ Cognitieve ondersteuning cliënt
    - □ Recreationele doeleinden cliënt
    - □ Communicatie en connectiviteit cliënt
    - □ Zorgverlening en cliënt gerelateerde administratie
    - □ Educatie zorgverleners
    - □ Instellingsadminstratie
    - □ Anders namelijk..

16. **(Trapsgewijs antwoord vraag 13) Heeft deze technologische innovatie in dit samenwerkingsverband ontwikkeld, geadopteerd of geïmplementeerd?**
    - □ Ontwikkeld
    - □ Geadopteerd
    - □ Geïmplementeerd
    - □ Ontwikkeld en geïmplementeerd
    - □ Geadopteerd en geïmplementeerd
    - □ Geen van alle opties namelijk…

17. **(Trapsgewijs antwoord vraag 12) Hoeveel individuen zitten in dit samenwerkingsverband?** …

18. **(Trapsgewijs antwoord vraag 12) Kunt u aangeven welk type partners in dit samenwerkingsverband zitten?** (meerdere antwoorden mogelijk)
    - □ Adviesbureau
    - □ Basis-en middelbare school

- Burgers
- Branchevereniging (bv. ActiZ)
- Cliënten en/of cliëntenraad
- Fysiotherapie of revalidatiecentrum
- Gemeente
- Kennisinstituut (universiteit, hogeschool, mbo-college).
- Lokale en/of nationale politici
- Ouderenzorginstelling
- Provincie
- Nationale overheid
- Non-profit organisatie
- Private organisatie
- Productontwikkelaar
- Politie
- Woningcorporatie
- Ziekenhuizen
- Zorgmedewerkers
- Zorgverzekering
- Anders namelijk…

19. (Trapsgewijs antwoord vraag 12) Kunt u aangeven op welk niveau dit samenwerkingsverband van toepassing is?

- Buurtniveau
- Gemeentelijk
- Regionaal
- Provinciaal
- Landelijk
- Internationaal

20. (Trapsgewijs antwoord vraag 12) Kunt u een inschatting geven hoe vaak u contact heeft met alle leden in dit samenwerkingsverband?

- Dagelijks
- 2/3 keer per week
- 3/4 keer per week
- Wekelijks
- Om de twee weken
- Maandelijks
- Een paar keer per jaar
- Jaarlijks
- Nooit

21. (Trapsgewijs antwoord vraag 12) Wat is de <u>voornaamste</u> reden om dit samenwerkingsverband aan te gaan?

- Gespecialiseerde diensten aan kunnen bieden
- Meer diensten kunnen leveren
- De kwaliteit van diensten verhogen
- Efficiëntere benutting van beschikbare middelen
- Collectieve actie problemen kunnen oplossen
- Risico spreiding
- Lobby
- Kennis verwerven
- Organisatieontwikkeling
- Verplichting vanuit de overheid
- Het bereik vergroten
- Anders namelijk…

22. (Trapsgewijs antwoord vraag 12) Welk <u>belangrijkste</u> middel kan uit dit samenwerkingsverband verworven worden?

- Diensten
- Financiële ondersteuning
- Toegang tot specifieke markten
- Logistiek
- Contacten
- Politieke ondersteuning
- Personeel
- Kennis
- Veiligheid (bv. financiële veiligheid)
- Verdeling van werk
- Anders namelijk…

Appendix C

Exploration of the variables related to characteristics of collaborative networks

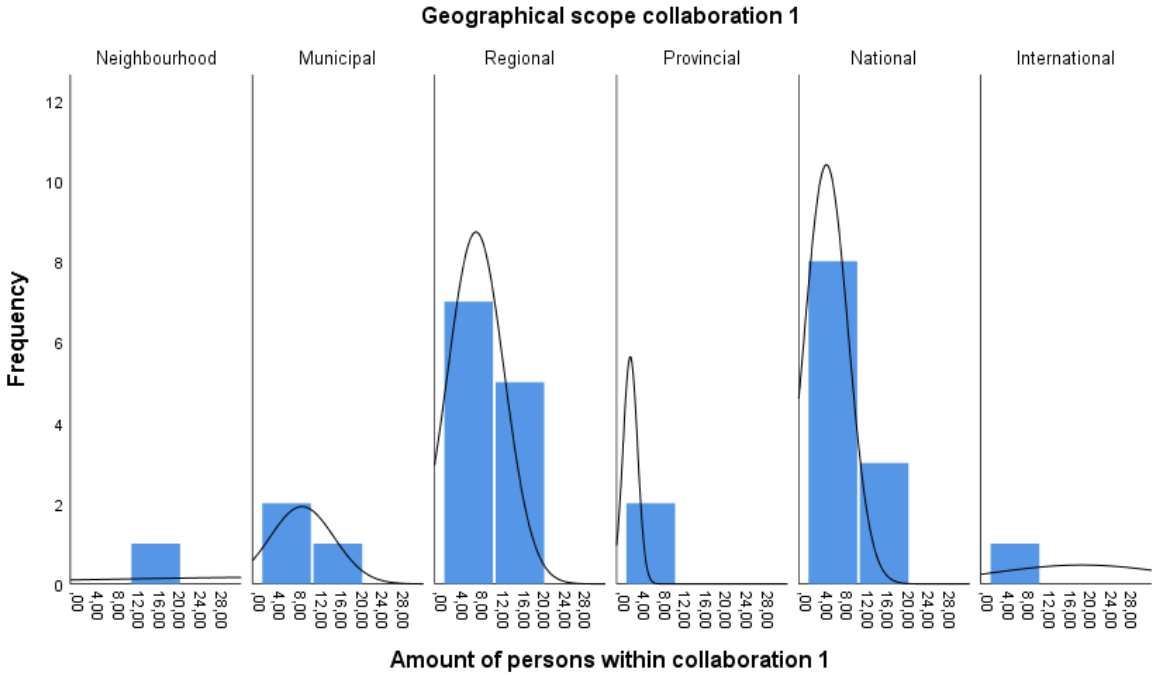

Figure C1. Histogram of geographical scope and amount of persons within collaboration 1

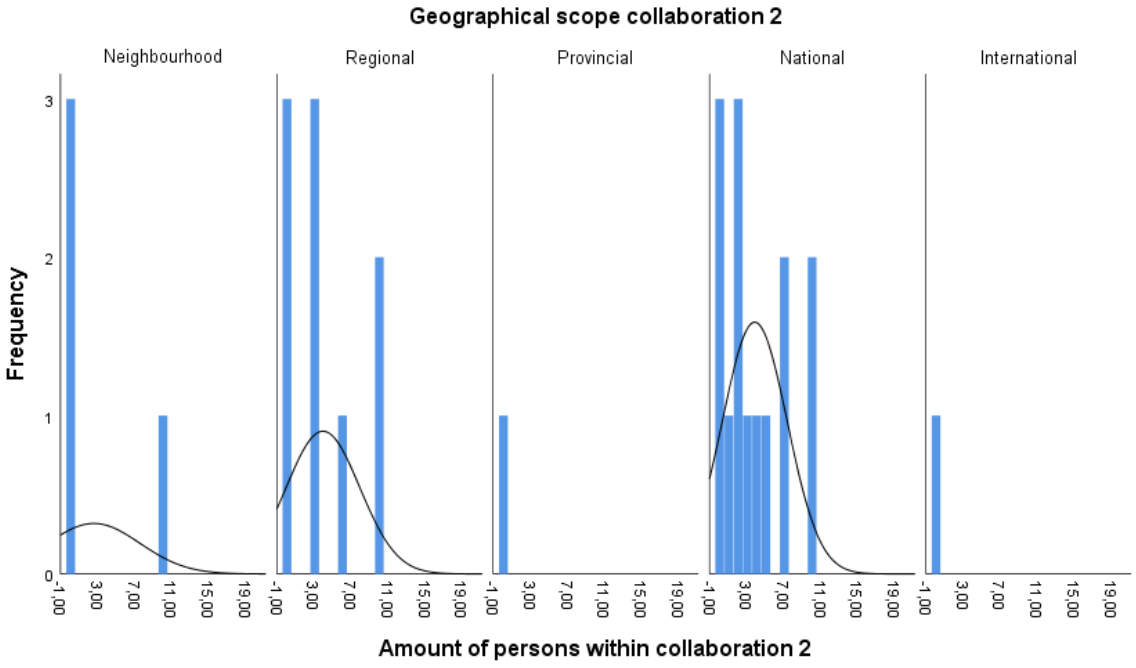

Figure C2. Histogram of geographical scope and amount of persons within collaboration 2

Note: This histogram is highly skewed. This is due to the fact that less respondents filled in the questions related to collaboration 2.

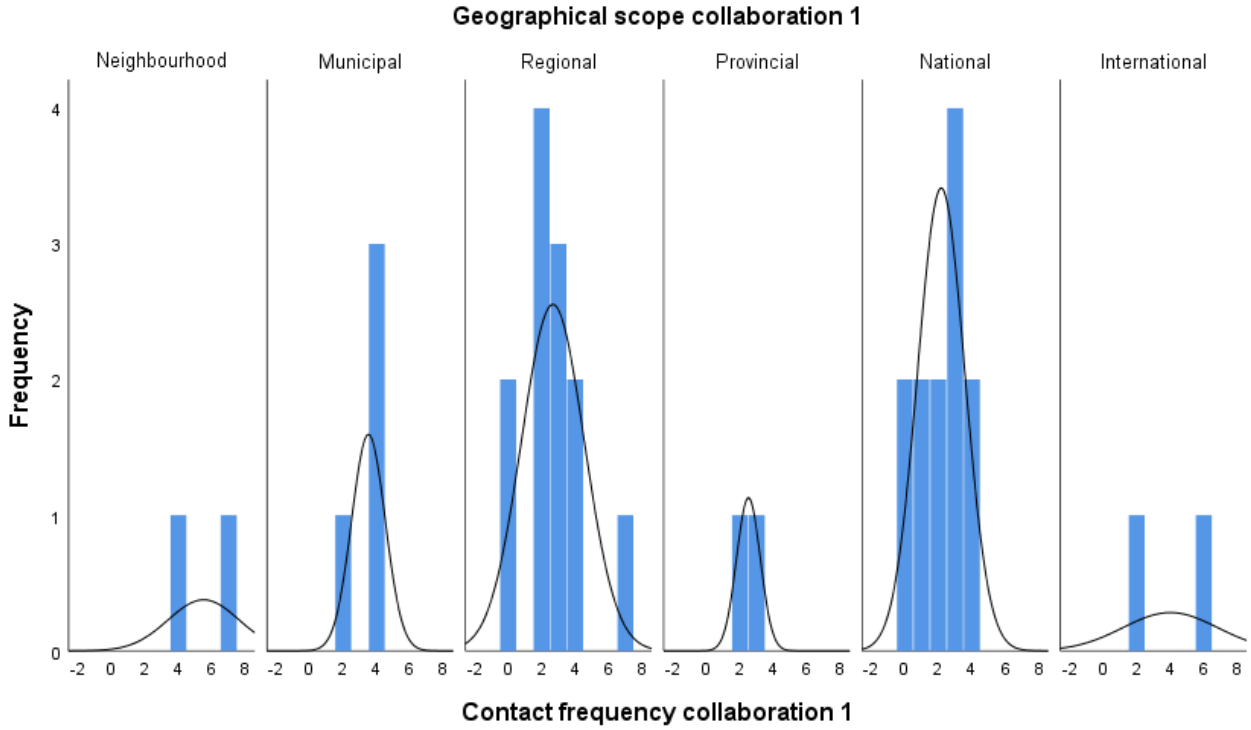

Figure C3. Histogram of geographical scope and contact frequency collaboration 1

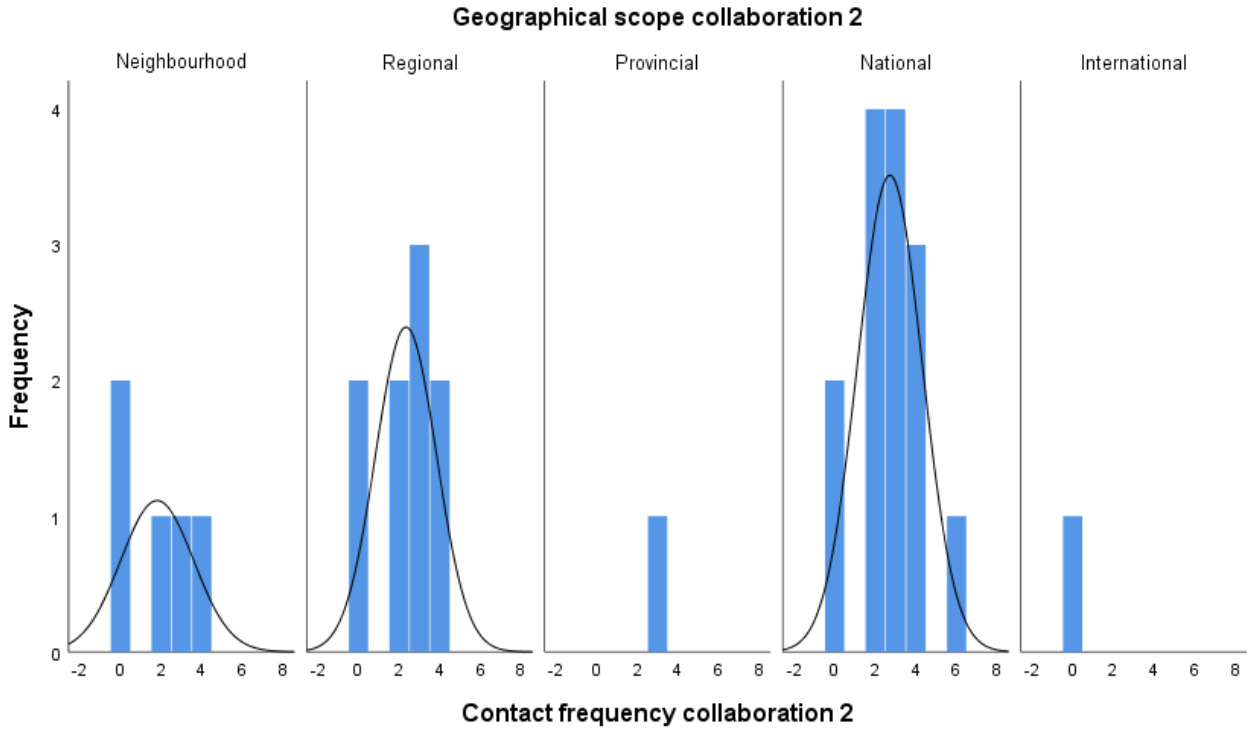

Figure C4. Histogram of geographical scope and contact frequency collaboration 2

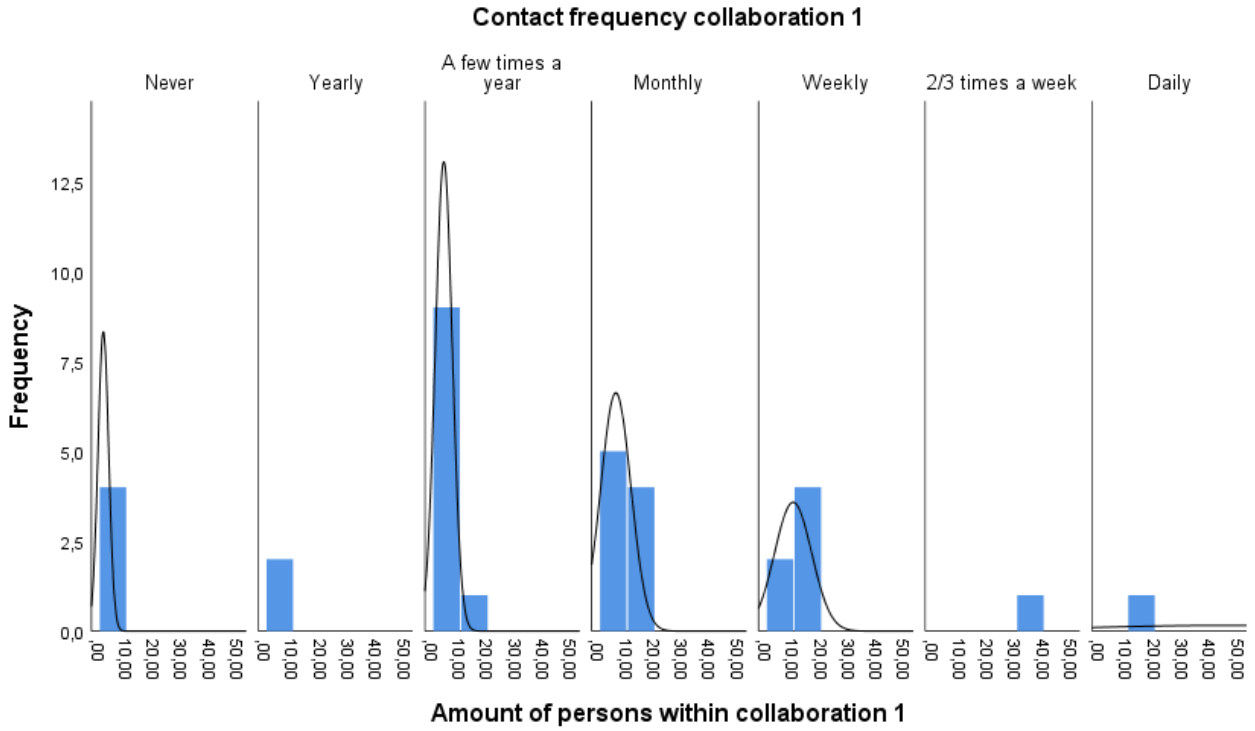

Figure C5. Histogram of contact frequency and amount of persons collaboration 1

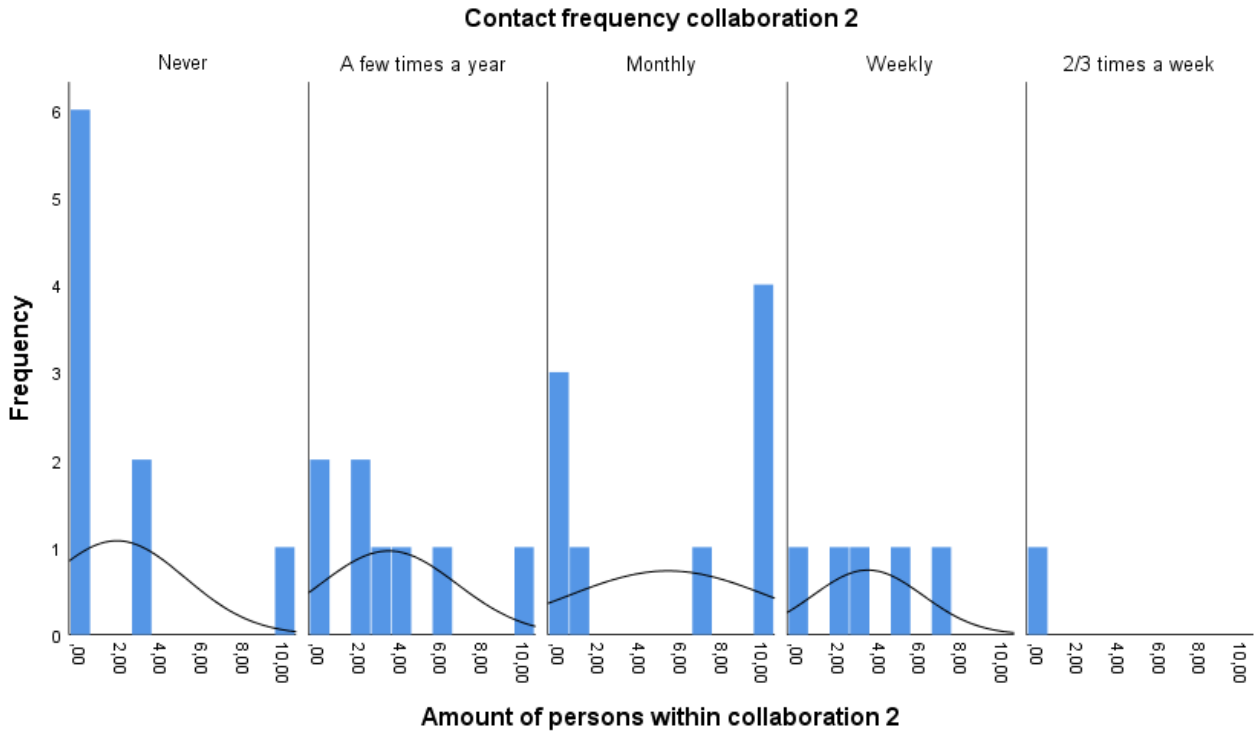

Figure C6. Histogram of contact frequency and amount of persons collaboration 2

Note: daily was not reported in collaboration 2.

Appendix D

Qualitative information technological innovation activities and technology

Table D1: *Technologies and their phase of establishment (C1, C2)*

Technology activity	Relevant mentioned technologies	Total (N)
	Collaboration 1	
Developed	Amber alert (SMS + photo) for freedom elderly with dementia Electronic medicine tracker Lifestyle monitoring E-Ware (lifestyle monitoring & robotics) Robotics Website New health care development structures	7
Adopted	Display with information of client in the room of client Camera's App: Eten & Zo GPS system (2x) Medication system (e.g. Medido) Calling system A care farm for elderly Not relevant: 2x implemented	10
Implemented	Domotica Moving sensors Registration system Medication system Electronical communication platform Robotics Magical Table for recreational purpose Support for implementing technology	8
Developed & implemented	Navigation Electronic patients system (ECD)	2
Adopted & implemented	Client portal Magical Table for recreational purpose Online platform: IQ messenger Surveillance camera's Lifestyle monitoring: Sensara Not relevant: adopted & implemented & all 3	7
Developed, adopted & implemented	Personalized technologies Sensor technologies	2

Collaboration 2		
Developed	Smart glasses for medication purpose	5
	Agenda for technological development issues	
	Telecare	
	Not relevant: in development/ I don't know	
Adopted	Opportunities for medical record	7
	Moving sensors	
	Medication app	
	Mattress with sensors	
	E-Ware (lifestyle monitoring & robotics)	
	(2x) Camera's	
Implemented	Alarm system	6
	Hospitality barometer	
	Medication system (e.g. EVS)	
	Client financial support (IPVB)	
	Smart mattresses	
	Not relevant: implemented	
Developed & implemented	Organizational system (e.g. OMAHA)	2
	Website	
Adopted & implemented	Communication: AMR	5
	Medication control system	
	Hardware & camera's	
	Working in cloud	
	Alarm	
Developed, adopted & implemented	Serious gaming	2
	Menu	